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(14)



- Interim Program Rpt

000-1 Final Rpt

001 - Pressurization

002 - Film Band Force

003-1 Hydraulic Log Bearing Assembly

004-1 Hi Pressure Test Rig

006-1 Transport Capabilities

007 - Tank of Thermal Control

008-1 Cleanroom Log Bearing module

- 2 009- Coefficient of Friction of joint

- 1 010 Vertical spacing

012-1 Gun Bearings

013-1 Log Bearings w/ Buckle pumps

013-2 Final Rpt Log Bearing

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CONTRACT STATUS REPORT
PROCESSOR DEVELOPMENT PROGRAM

Contract

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Period from 1 July 1964
to 1 September 1964

9 September 1964

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1. INTRODUCTION

STAT This document is the first contract status report in a series to be submitted in accordance with the statement of work contained in Contract [] for the U.S. Government.

2. SUMMARY OF WORK PERFORMED

Work performed on this contract between 1 July 1964 and 1 September 1964 is reported in the following subsections. In general, the work falls into two categories: design of the laboratory facility and investigation and planning of research projects for the coming period.

2.1 LABORATORY DESIGN

Following receipt of the contract, [] was engaged to design and install cleanroom facilities. [] founded over a decade ago, has designed and installed superclean environments in more than 100 manufacturing plants, research laboratories, and government centers. STAT
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STAT The [] installation will be a prefabricated, modular, controlled-environment area with more than 1200 square feet of floor space. Two entrance-exit units will be installed at strategic locations. The entrance-exit units are prepackaged air showers that are scientifically designed to provide a shower of ultraclean air to dislodge dust and lint particles from the clothing and person of those entering the cleanroom area. Accidental room contamination is prevented by an electrical door-interlock alarm system.

The clean area will consist of two rooms for installation of processing equipment, a sensitometric exposure room, and a photographic evaluation laboratory. Each of the four rooms will have stainless-steel

walls and ceilings and a conductive linoleum floor to eliminate static electricity.

A 10-ton air-conditioning system will be installed. Incoming air will be filtered to 1-micron purity under nonoperating conditions. Temperature and humidity controls will permit the adjustment of these two parameters to suit tests being conducted.

The working floor in the cleanroom area will be approximately 30 inches above the existing floor. This will permit installation of chemical lines, water lines, and electrical conduit to a film processor which will be mounted on a concrete load-block that is flush with the working floor.

Offices, laboratories, and support equipment for the research laboratory, will be located in areas adjacent to and around the perimeter of the cleanroom laboratory. Considerable design effort has been directed toward a layout that will provide an efficient and functional arrangement. After initial study and evaluation of these activities was completed, a layout of the entire facility was prepared. a licensed structural engineering firm, was engaged to prepare the final architectural drawings. A copy of the floor plan is attached to this report. A review of this plan will reveal the following features:

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1) Safety. Halls and exits have been properly located and spaced to provide safe, rapid egress under emergency conditions. Initial discussions with city engineers were conducted, prior to obtaining construction permits, to resolve any safety problems. Although they are not shown in the layout, protective hoods and safety showers will be installed in the chemical laboratory. An additional safety shower will be installed in the chemical mixing area at a later date if dangerous color chemicals are used.

2) Security. The security level of the research laboratory will be maintained by rigid control of personnel security clearances and access to the area. Special badges have been issued to laboratory personnel and security clearances for all personnel working in the area are being processed. Upon completion of the laboratory, access to it will be possible through a magnetic card-controlled security entrance.

3) Work Flow. Further evaluation of the layout submitted in the technical proposal showed that an improvement could be made by relocating the chemical mixing facilities. This modification enables the raw chemicals to be more easily moved from the receiving area to a mixing area adjacent to the HTA-5 service unit. The new layout also permits the existing chemical laboratories to remain intact. In addition, a new entrance from the hall to the analytical chemistry laboratory will permit entrance to or exit from that room without disturbing operations in any adjacent area.

A review of projects planned for the laboratory indicated that more office space would be desirable to house research personnel. Accordingly, some revision was made to the office area layout. This necessitated relocation of the electronics and optics laboratory and the model shop shown on the layout proposed in technical proposal 4W-1434. The electronics and optics laboratory is now located in the west area of the research facility. The model shop is located in another building.

In summary, the new laboratory design provides the above advantages without any reduction in cleanroom area.

2.2 WATER SUPPLY AND DRAINS

The necessity for pure water for chemical mixing was investigated, and a water deionizing system was installed. Water from the city supply line now flows through a mixed-resin bed and is piped to chemical mixing and laboratory areas through polyvinyl chloride pipes. Silver-plated

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faucets at the outlets insure that the water will not be contaminated. An indicating system on the resin bed shows when it must be replaced.

Discussions with city engineers will be held to verify that discharge of photographic chemicals into the city sewage system will be conducted in accordance with approved methods.



3. PLANS FOR THE NEXT PERIOD

The following activities are scheduled for the next reporting period:

- 1) Initial approval of the preliminary Baker design will be finalized by 4 September.
- 2) Architectural plans for the laboratory will be completed by 10 September and submitted for issuance of construction permits.
- 3) Modular units will be received about 21 September.
- 4) Installation of the facility will begin during the second week of October, providing construction permits have been received by that time.
- 5) Evaluation of the positive-pressure and negative-pressure vacuum capstans will begin about 15 September. The appendix contains details of investigations performed on the positive-pressure capstan and a summation of the negative-pressure capstan characteristics.

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APPENDIX A
TEST REPORT
POSITIVE PRESSURE VACUUM CAPSTAN

STAT conducted a program of investigation on a new technique for generating and applying a vacuum to a rotating film drive capstan. This technique involves the generation of a vacuum by passing high-velocity air through a shaped annular orifice and connecting vacuum lines to an opening in the throat of this orifice.

Two capstans were fabricated for this program. The first one, 3 inches in diameter, was used to obtain most of the test data in this report (Figure A-1). A second capstan, 6 inches in diameter, was fabricated after accumulation of all data. The second capstan is a working model that will drive all film widths from 70mm to 9-1/2 inches, with film base thicknesses up to 0.0012 inch.

In connection with this program, tests were conducted to determine the force required to bend film 180 degrees with various radii of curvature from 0.5 inch to 5 inches. These tests were performed on 0.0025, 0.0055, and 0.0085-inch-thick dry film. The diameter of the final capstan was established as the result of these tests.

THEORY OF OPERATION

The vacuum capstan is operated on the Venturi principle, to generate a vacuum in the rotating member of the capstan. Figure A-2 shows a cross-section of a positive pressure capstan, and is used to illustrate the principle of generating a vacuum in an annular orifice.

Under positive pressure, air enters the capstan parallel to the axis of rotation. The air is deflected outward so that it exits from the

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capstan radially to the axis of rotation between a fixed and a rotating member. A circle of maximum restriction is found between the two members. This is shown at point B in the sketch. The pressure at this restriction point is inversely proportional to a function of the velocity of the air passing through this restriction.

With several openings made around the circumference of the capstan at the throat of the annular orifice, a multiplicity of vacuum lines are created. Each of these lines is connected to the surface of the rotating member of the capstan, where it is desired to drive the film. In this case it is at the midpoint of the capstan so that all sizes of film can be driven.

The force holding the film to the capstan is dependent on the differential pressure on the two sides of the film and to the area over which this differential pressure is applied. A greater driving force for the film can be created by increasing the area served by each vacuum port on the capstan. This can be done by providing a rough surface around each port or by providing a pattern of grooves connected to each port.

Most capstans are required to hold film over a fixed angle, which is related to the angle of rotation. This is usually 180 degrees or less, depending on the configuration of the machine in which they are used. Beyond the wrap of film it is necessary that the capstan release the film. This is done with the positive-pressure capstan by providing a vane on the fixed member, across the outlet of the orifice, so that a back-pressure is created, thereby reducing the velocity through the throat at the desired release point. If a high enough back-pressure is obtained, this will not only eliminate the vacuum but also provide a positive pressure to separate the film from the rotating capstan.

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TEST RESULTS

The first test conducted was to determine the force required to bend film 180 degrees with different radii of curvature. This was done by hanging 15-inch lengths of film over a roller and adding weights until the film touched the roller over an angle of 180 degrees. The diameter of the rollers used was 0.5, 1, 2, 3, and 5 inches. Three different film thicknesses were tested: 0.00257, 0.0056, and 0.0085 inch; and four different widths of each film base was tested: 35mm, 70mm, 5 inches and 9-1/2 inches. In each test the plotted results yielded a real half of a hyperbola. These curves are shown in Figures A-3A through A-5D. In each case, the break in the curve occurred for a diameter of 5 inches or greater. For this reason, the final capstan was made with a 6-inch diameter so that undue forces would not be required for the sole purpose of bending the film.

A second set of tests was conducted on the 3-inch capstan to determine vacuum pressure in inches of mercury as a function of the volume or volume of air per minute used. These results are shown in Figures A-6A and A-6B. Each is an average of four vacuum ports in one particular position; that is, one relationship to the fixed member. These positions are indicated as A and B on the curves. Above about 6 cfm, the curve remains linear for the volume rate of flow. The break in these curves is unexplained at this time.

FUTURE PROGRAM

In the near future, a program will be conducted to compare the positive-pressure 6-inch capstan to a negative-pressure 6-inch capstan. Parameters which will be compared are overall efficiency, film driving forces, and all the other parameters associated with vacuum capstans. The negative-pressure capstan (Figure A-7) to be used in this investigation was developed by

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The negative-pressure capstan, shown schematically in Figure A-8, utilizes a vacuum pump, having a capacity of up to 4 inches of water, as a vacuum source. Vacuum from the pump is applied to the rear stationary section of the capstan through a flexible tube. The stationary section contains a vacuum restriction plate and a PVC backup plate that acts as a retainer for a Teflon bearing. Interchangeable Teflon plates can be provided to limit vacuum distribution to 180 degrees, 90 degrees, or other radii of film wrap.

The capstan has an annular hollow slot that conducts air from the holes in its surface, through the slot, to the Teflon restriction plate. Numerous holes are arranged in a 70mm wide pattern in the center of the capstan. However, the width of the capstan is sufficient to enable film up to 9-1/2 inches wide to be transported. The capstan has a slight crown so that film seeks its center to provide automatic and precise tracking.

Cleaning and servicing of the capstan can be accomplished by simply removing a single retaining knob and removing the rotating member. Provision is made for transport of film in both dry and wet sections of the processor.

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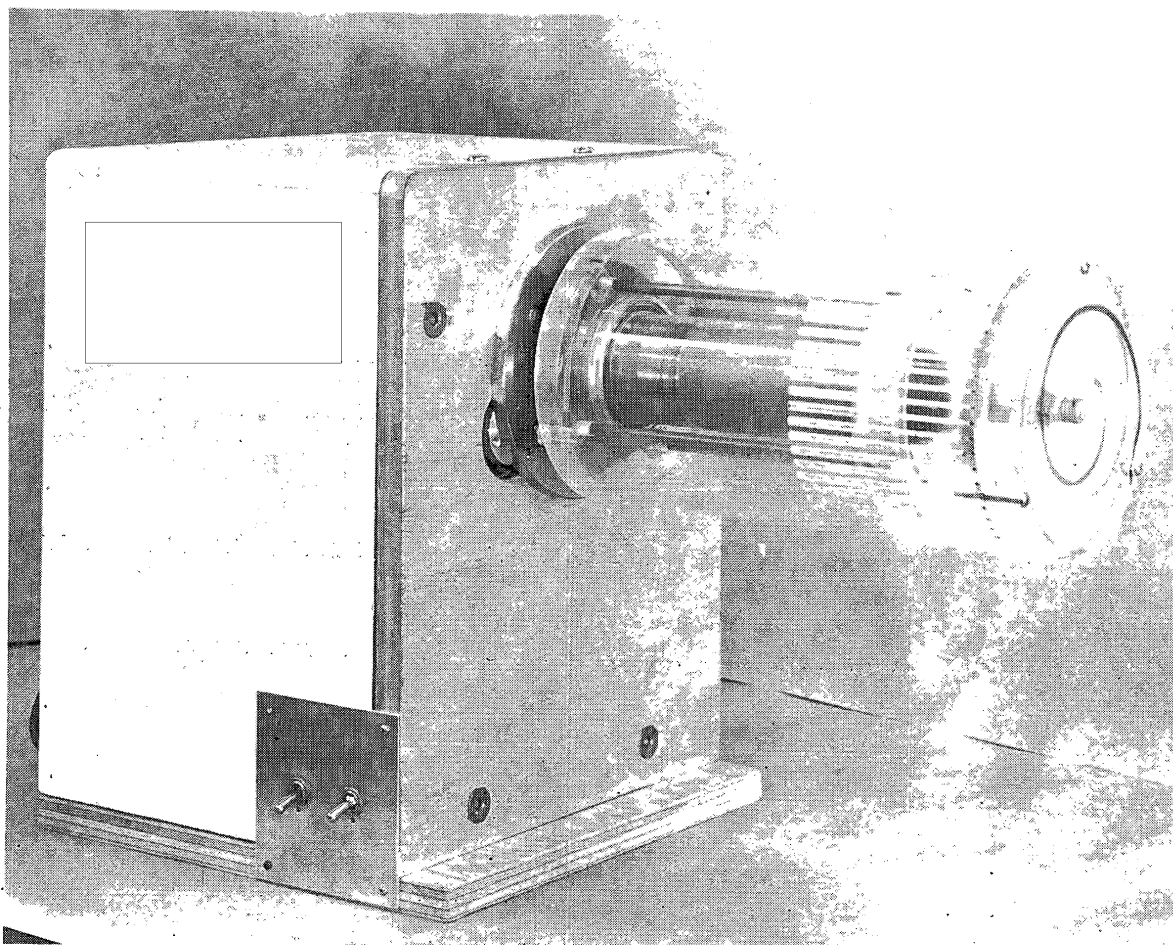


Figure A-1. Vacuum Capstan Test Model

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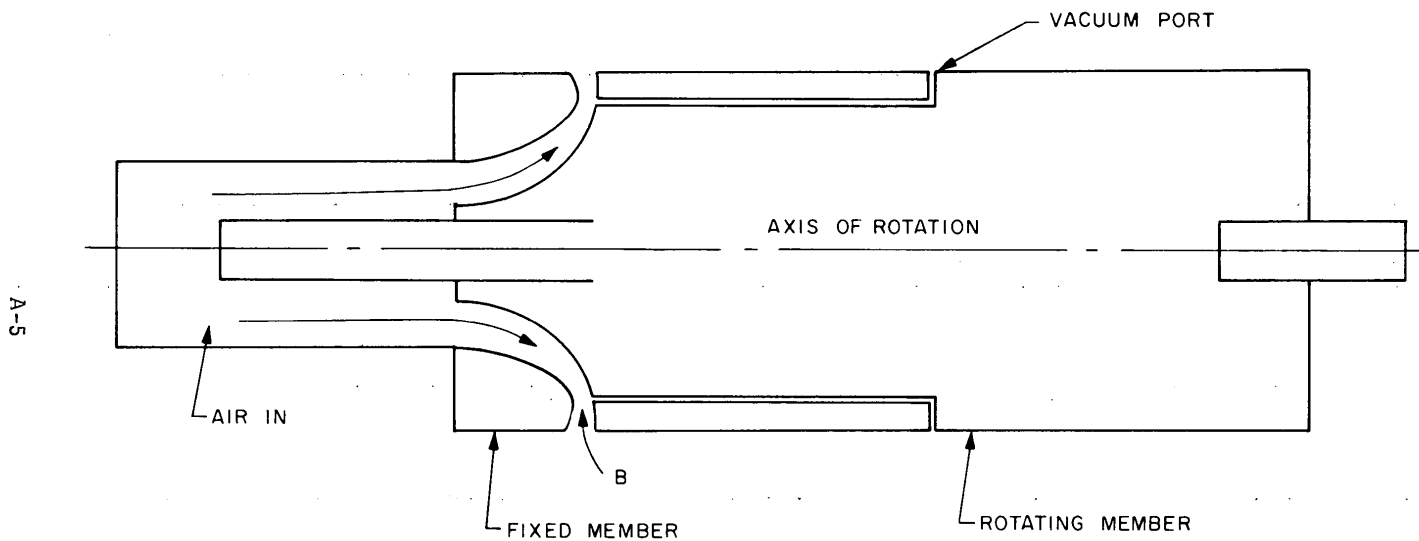
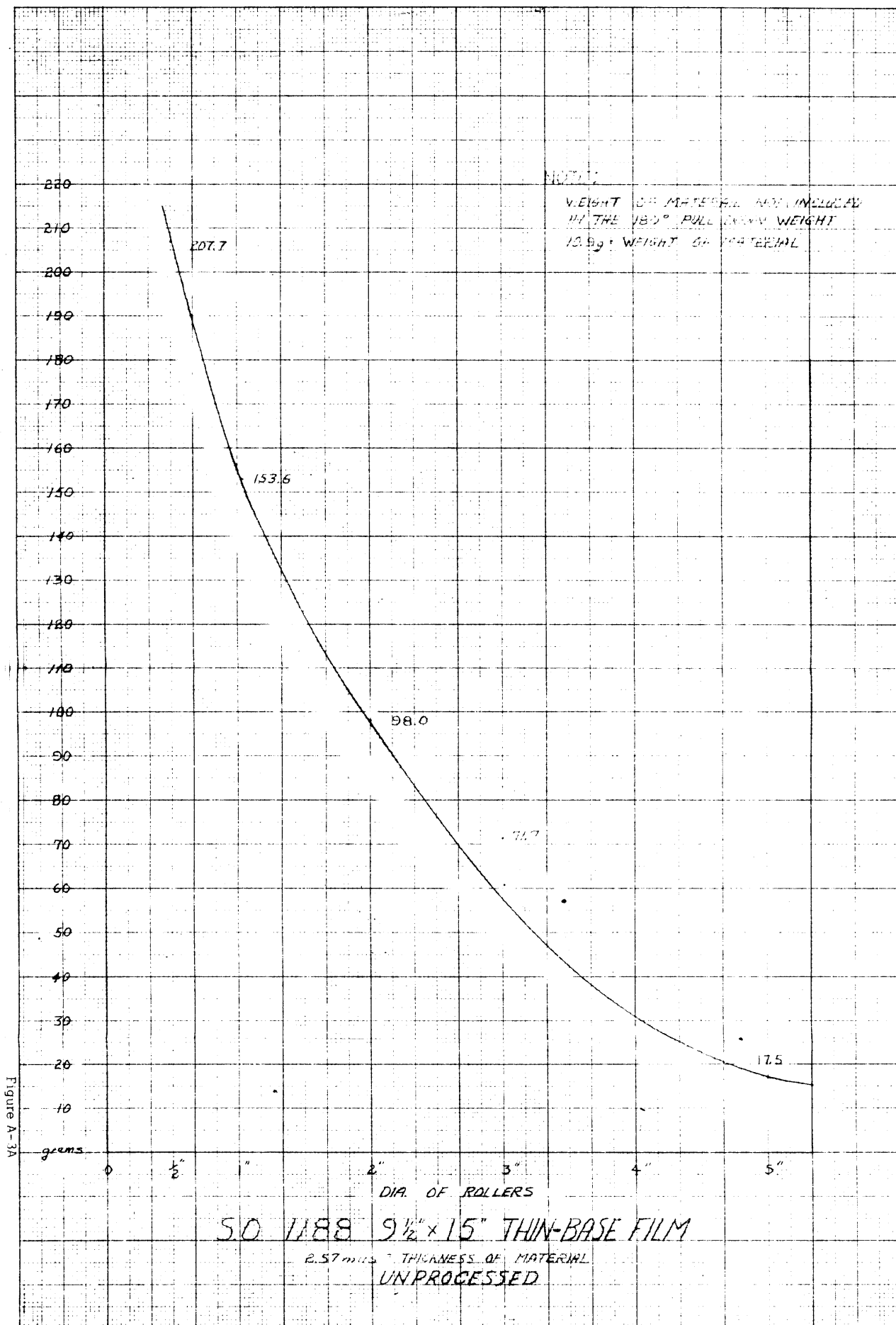
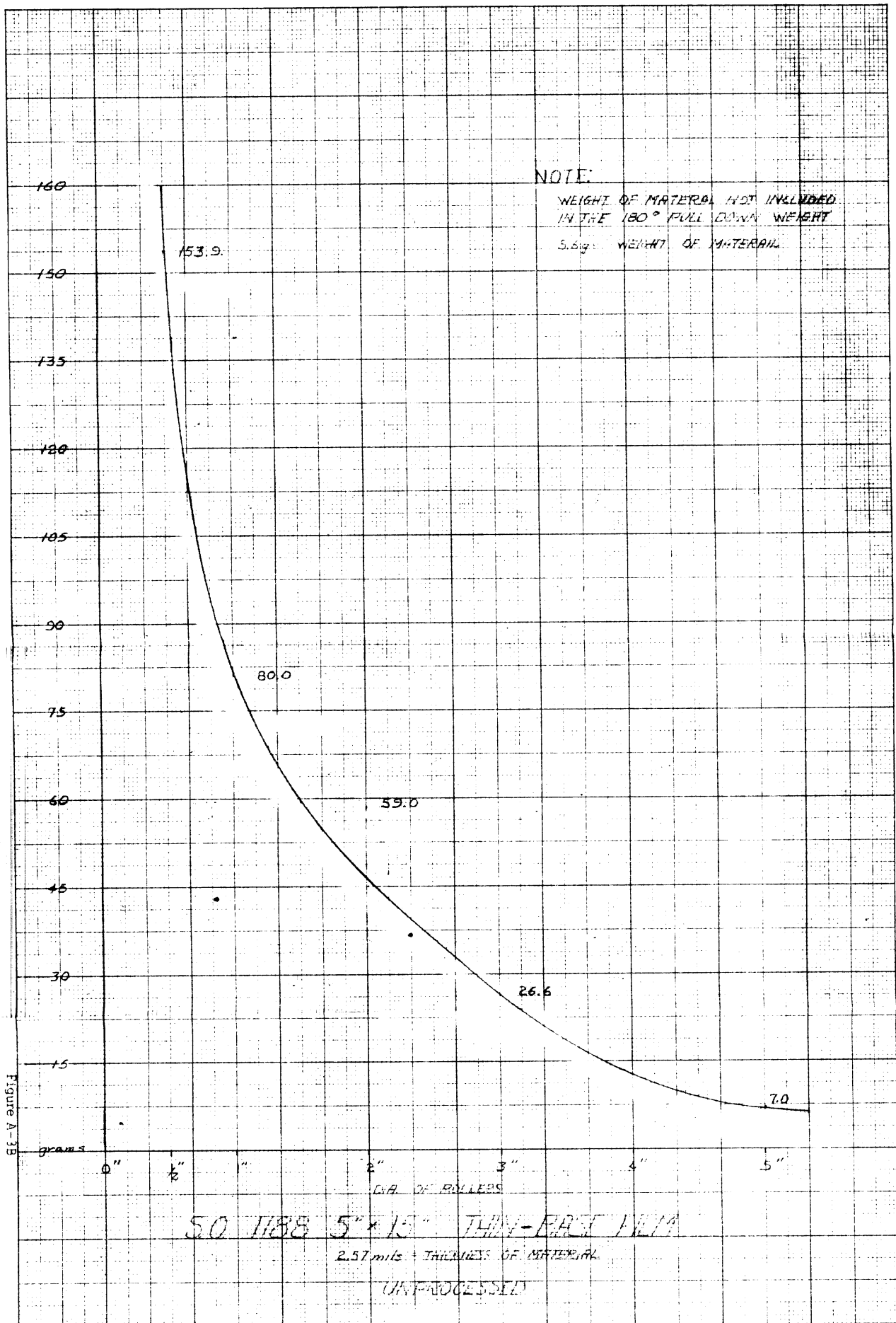


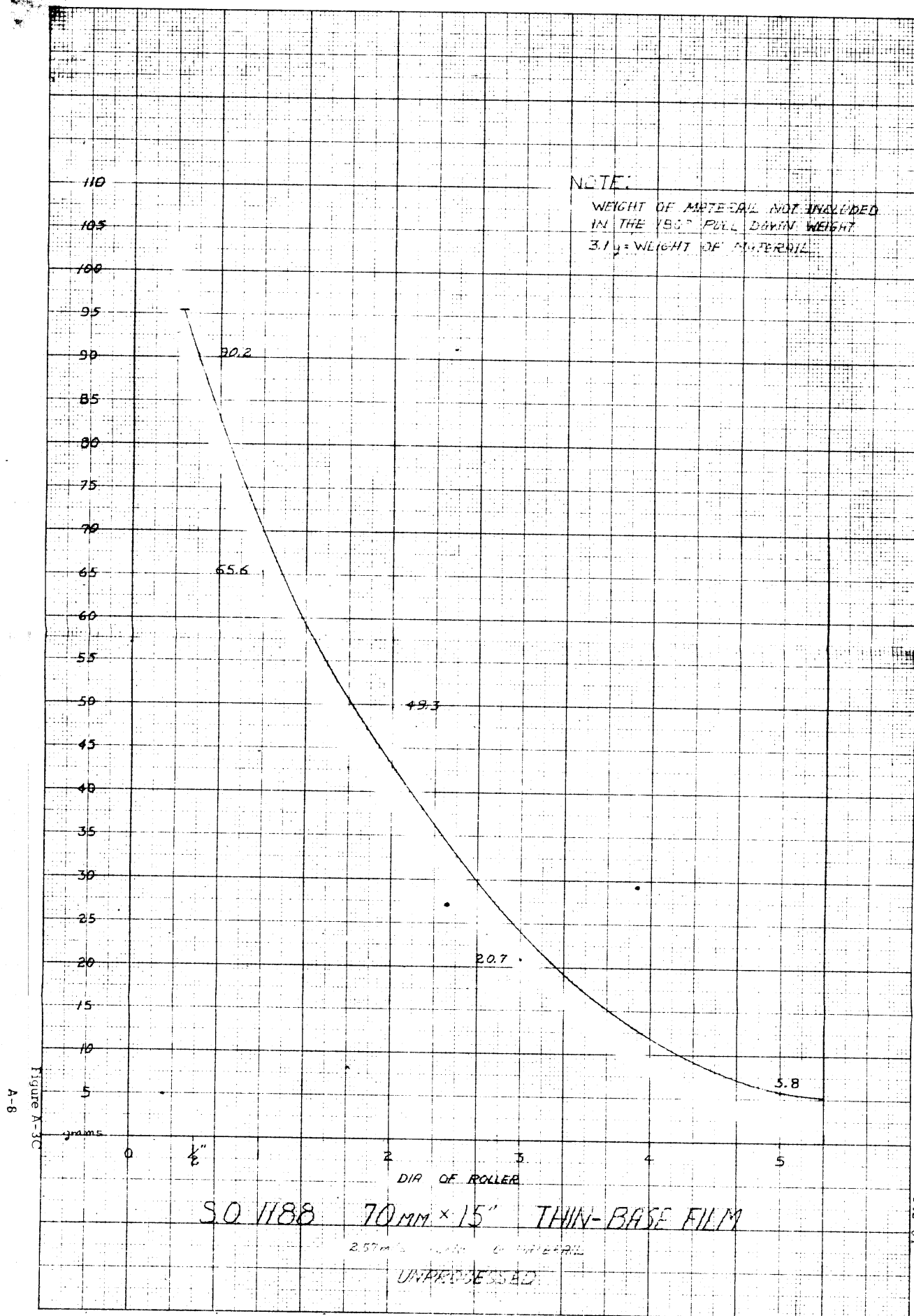
Figure A-2. Positive-Pressure Vacuum Capstan

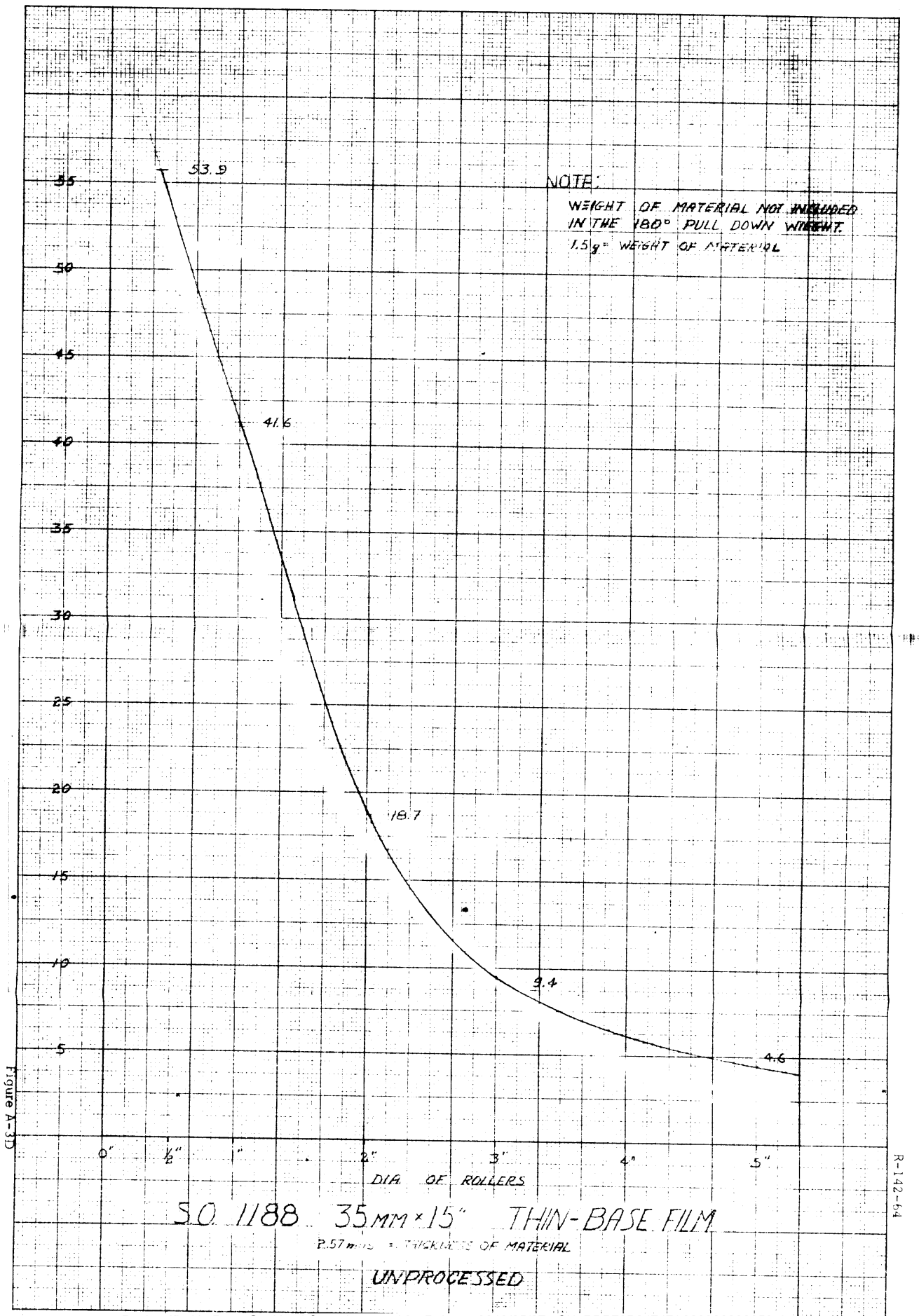
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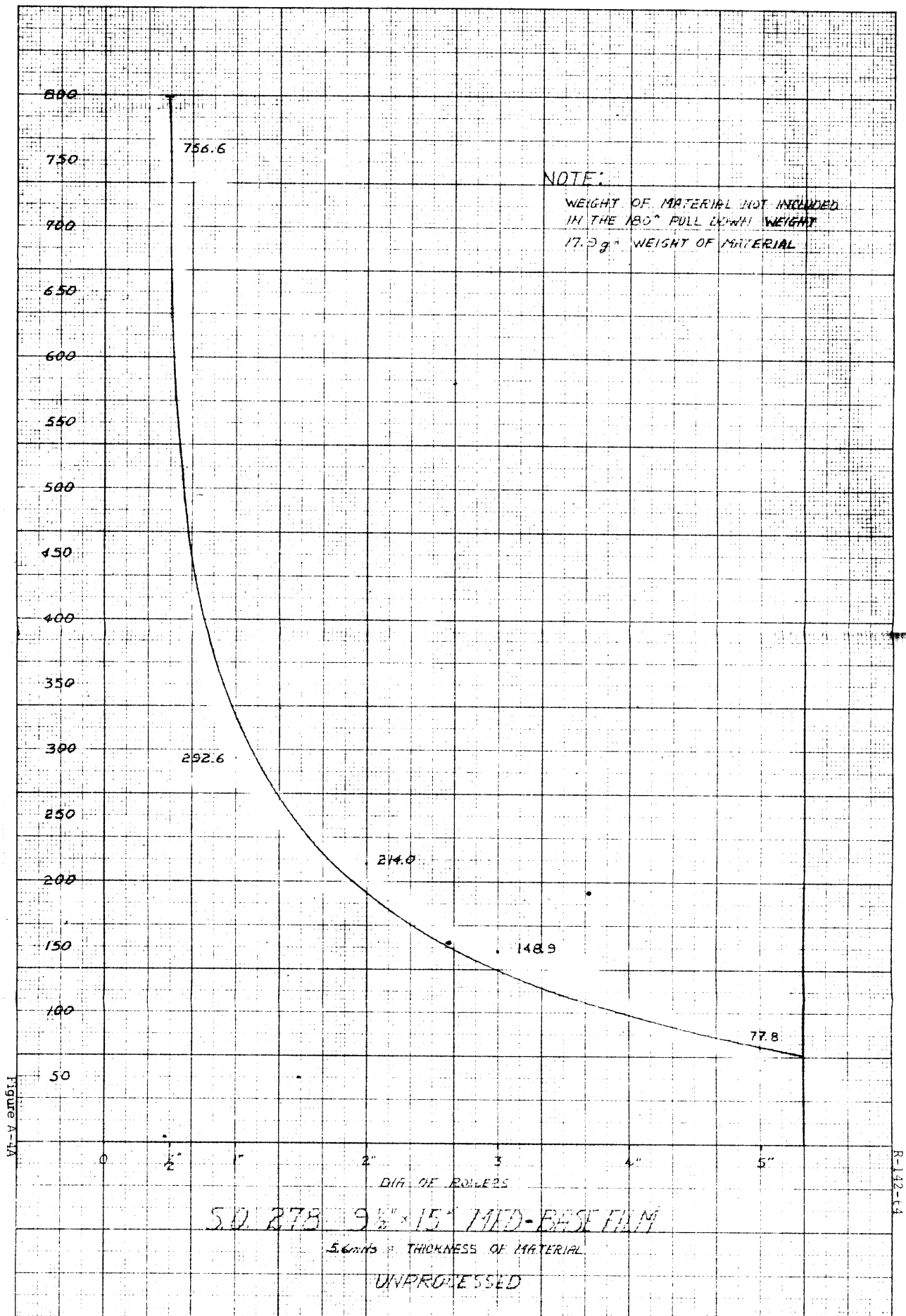
Figure A-3A
A-6

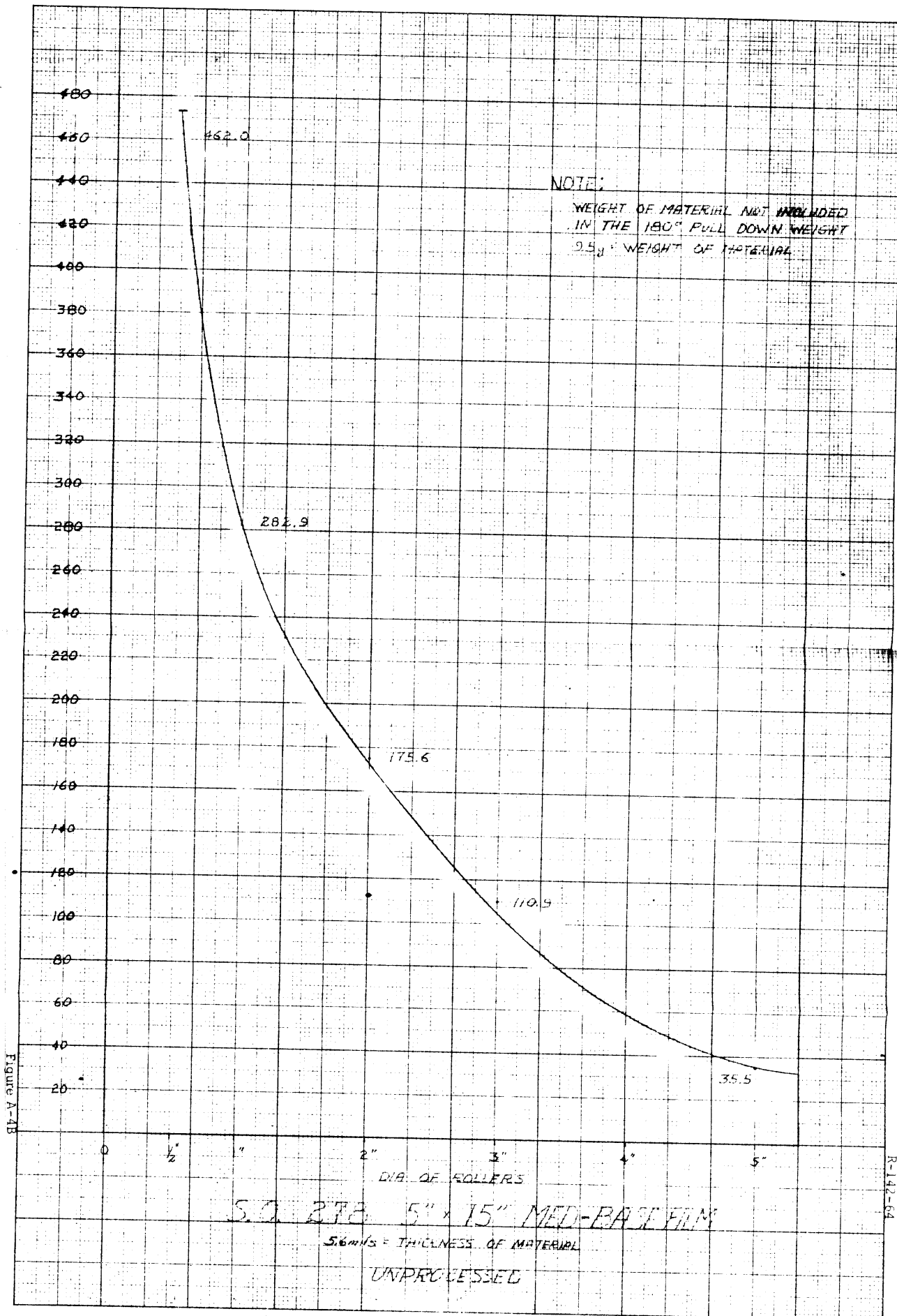
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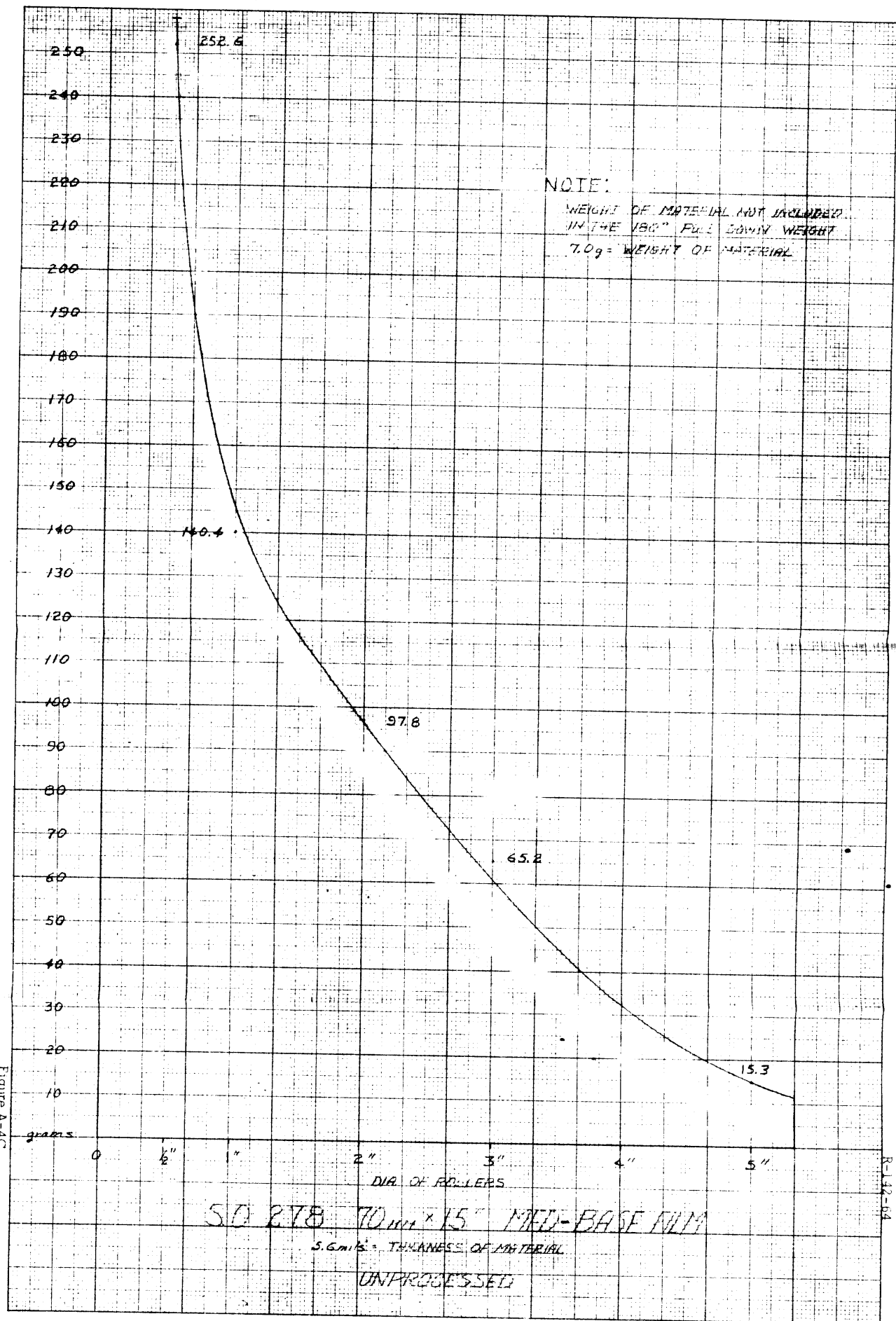


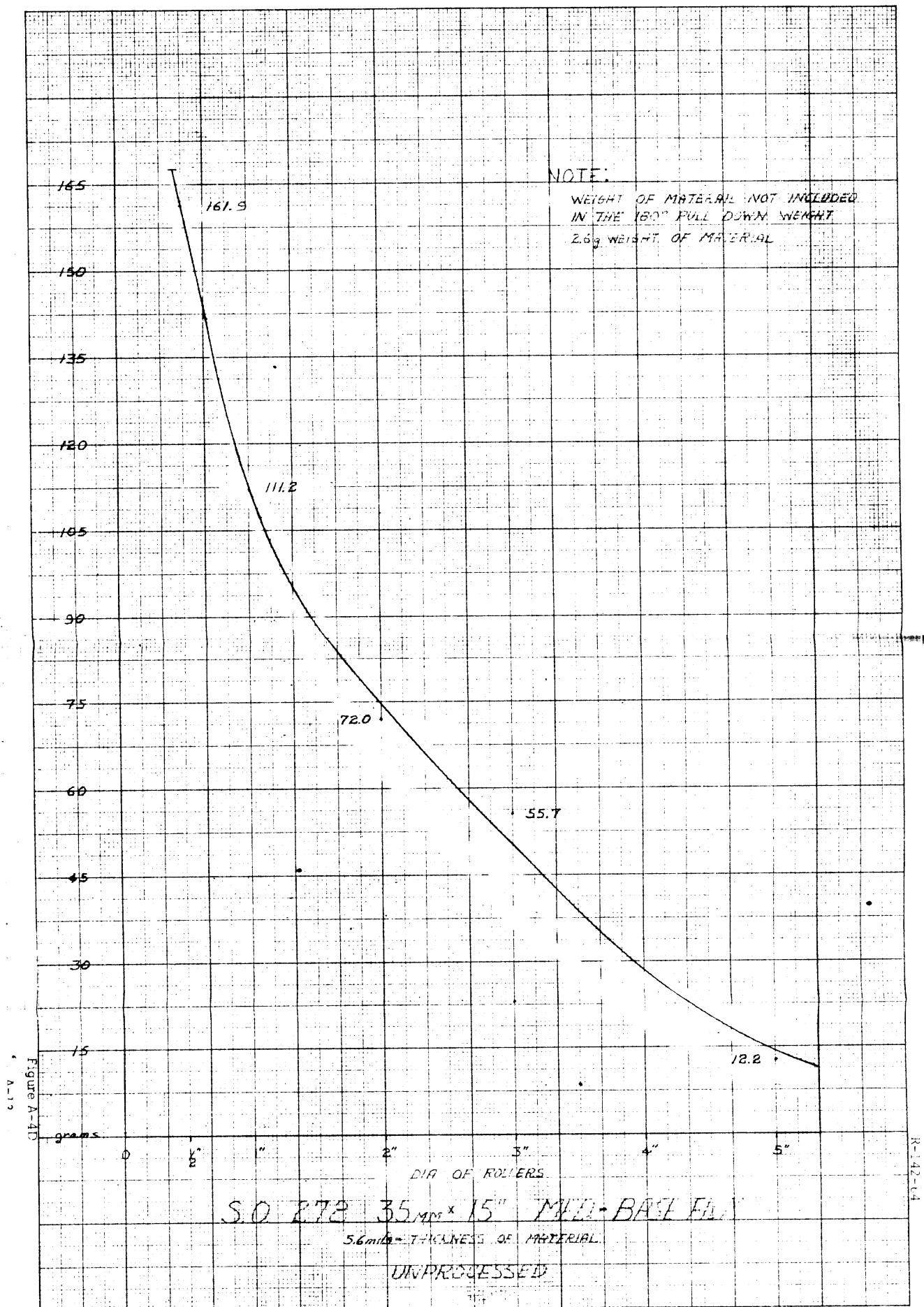


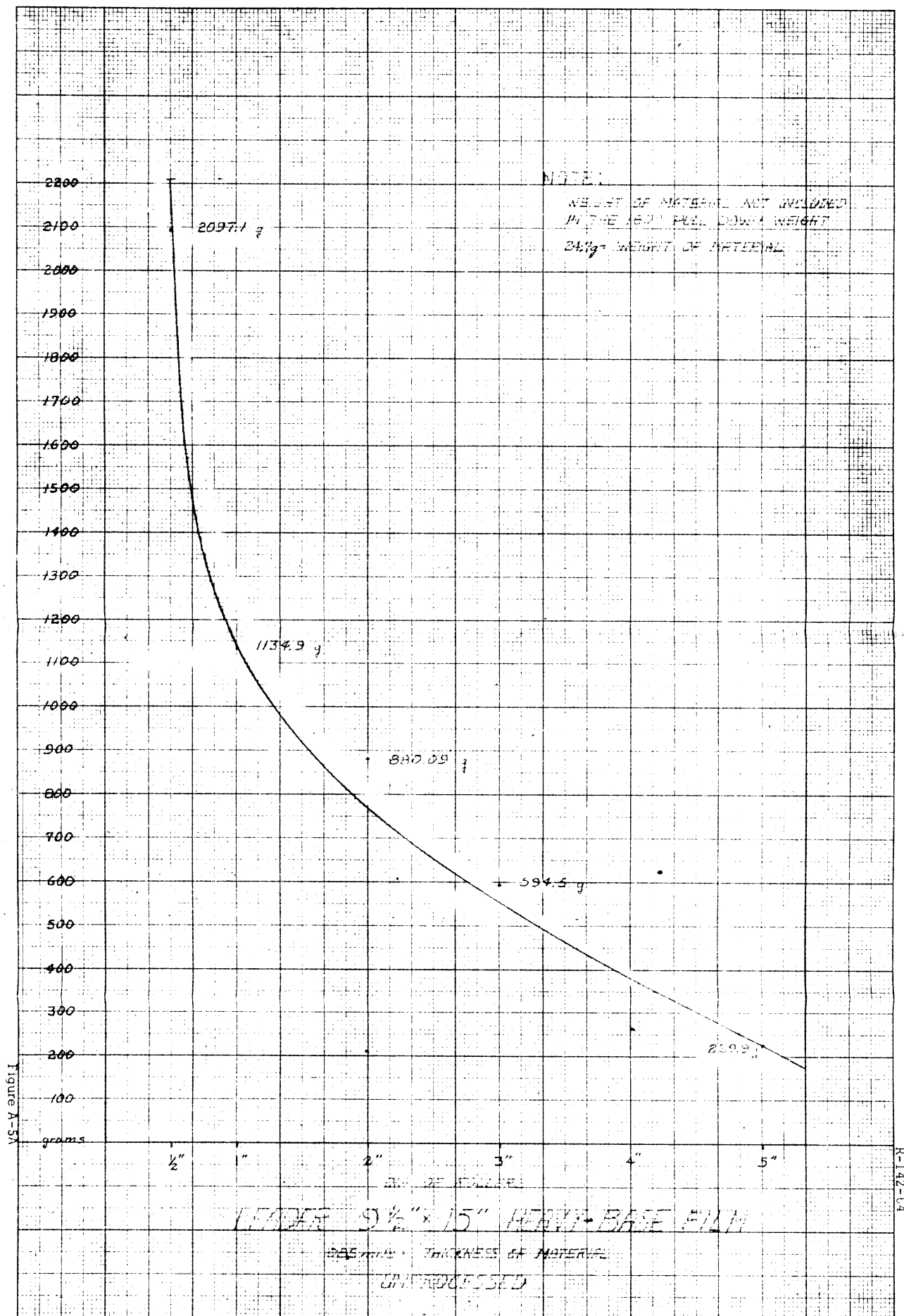


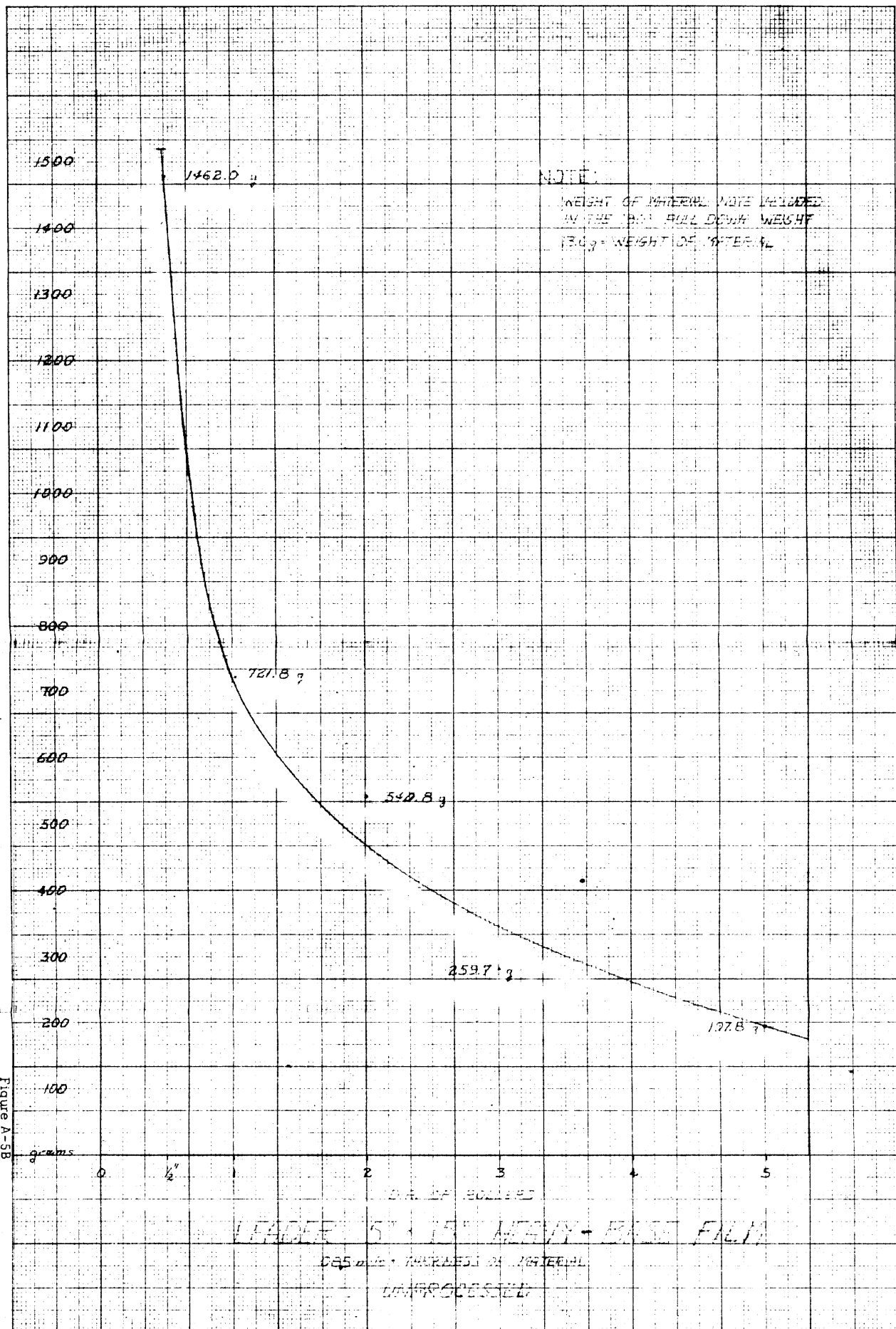




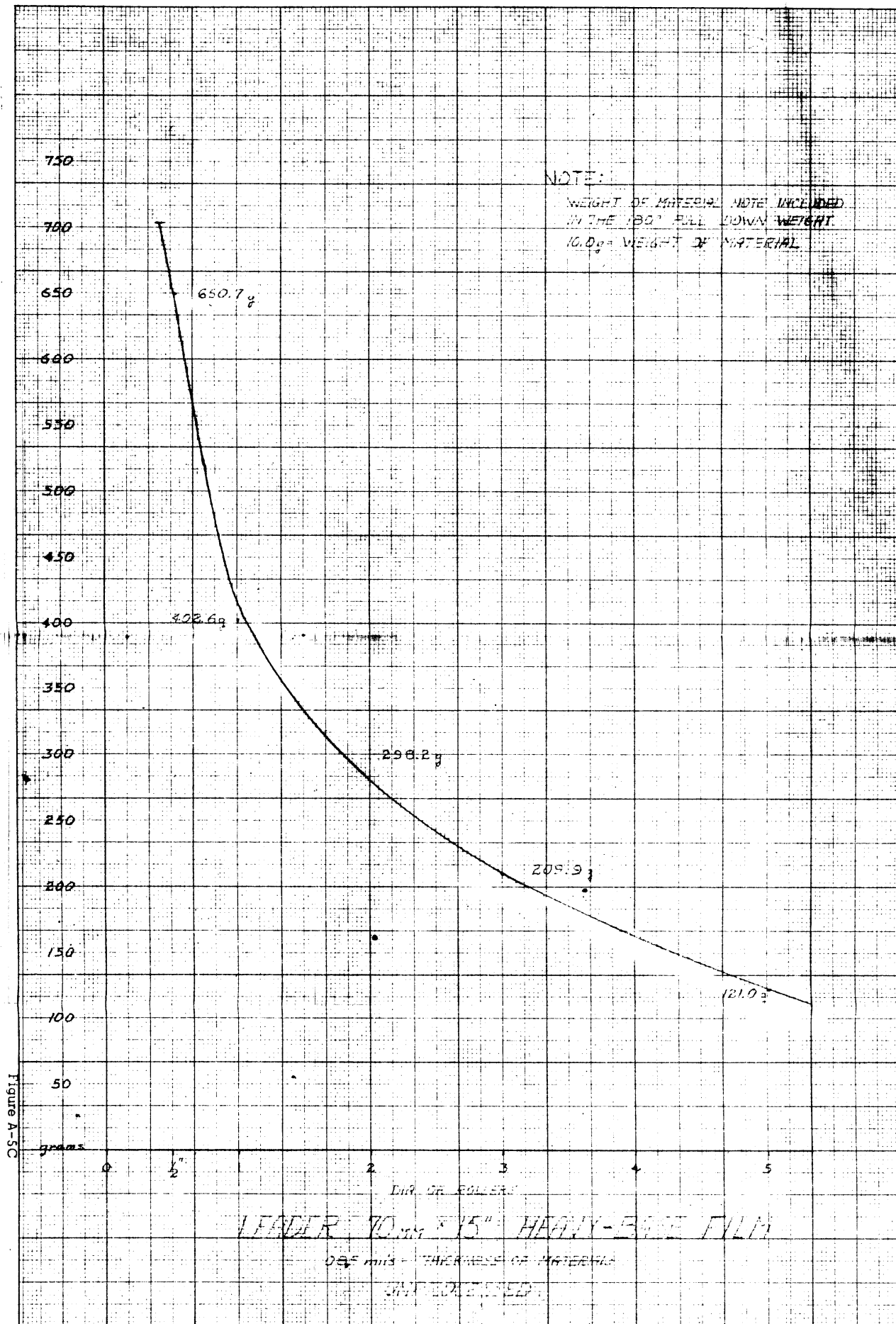






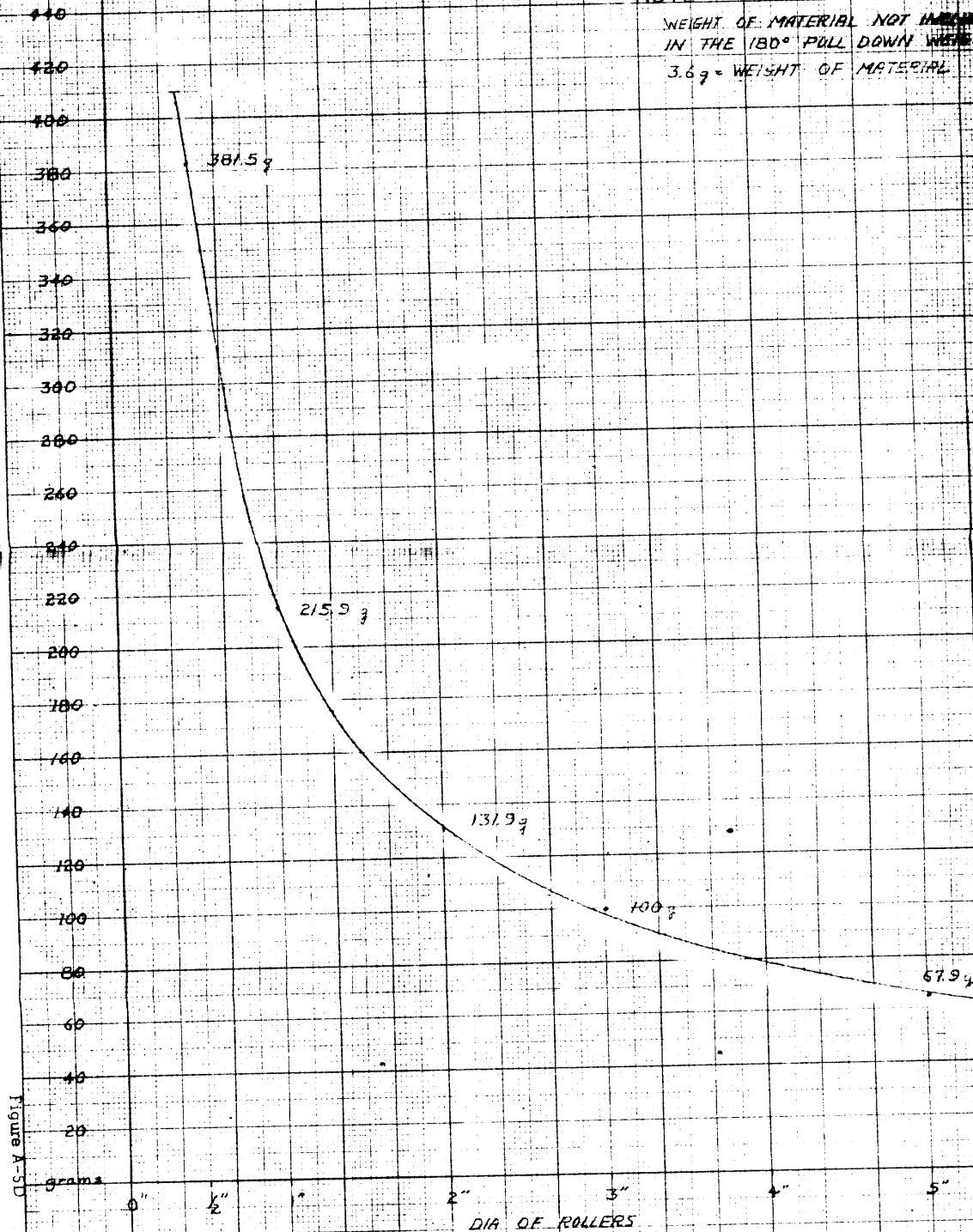
Figure A-5B
A-15

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NOTE:

WEIGHT OF MATERIAL NOT INCLUDED
IN THE 180° PULL DOWN WEIGHT
3.6g = WEIGHT OF MATERIAL



LEADER 35mm x 15" HEAVY-BASE FILM

0.05 mm ± THICKNESS OF MATERIAL

UNPROCESSED

A-17

Figure A-5D

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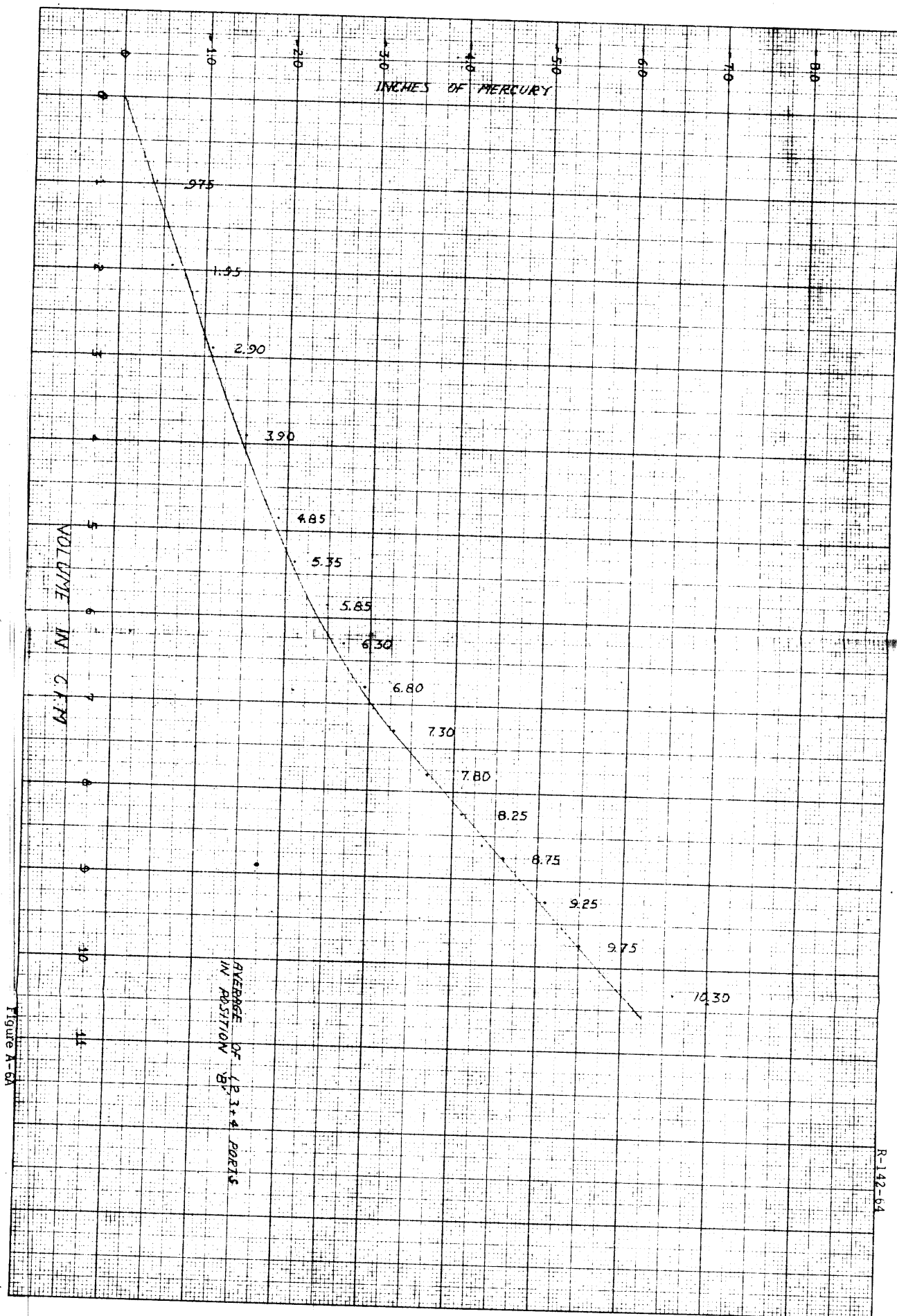
K-E 20 X 20 TO THE INCH 359-10%LG
KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure A-6A

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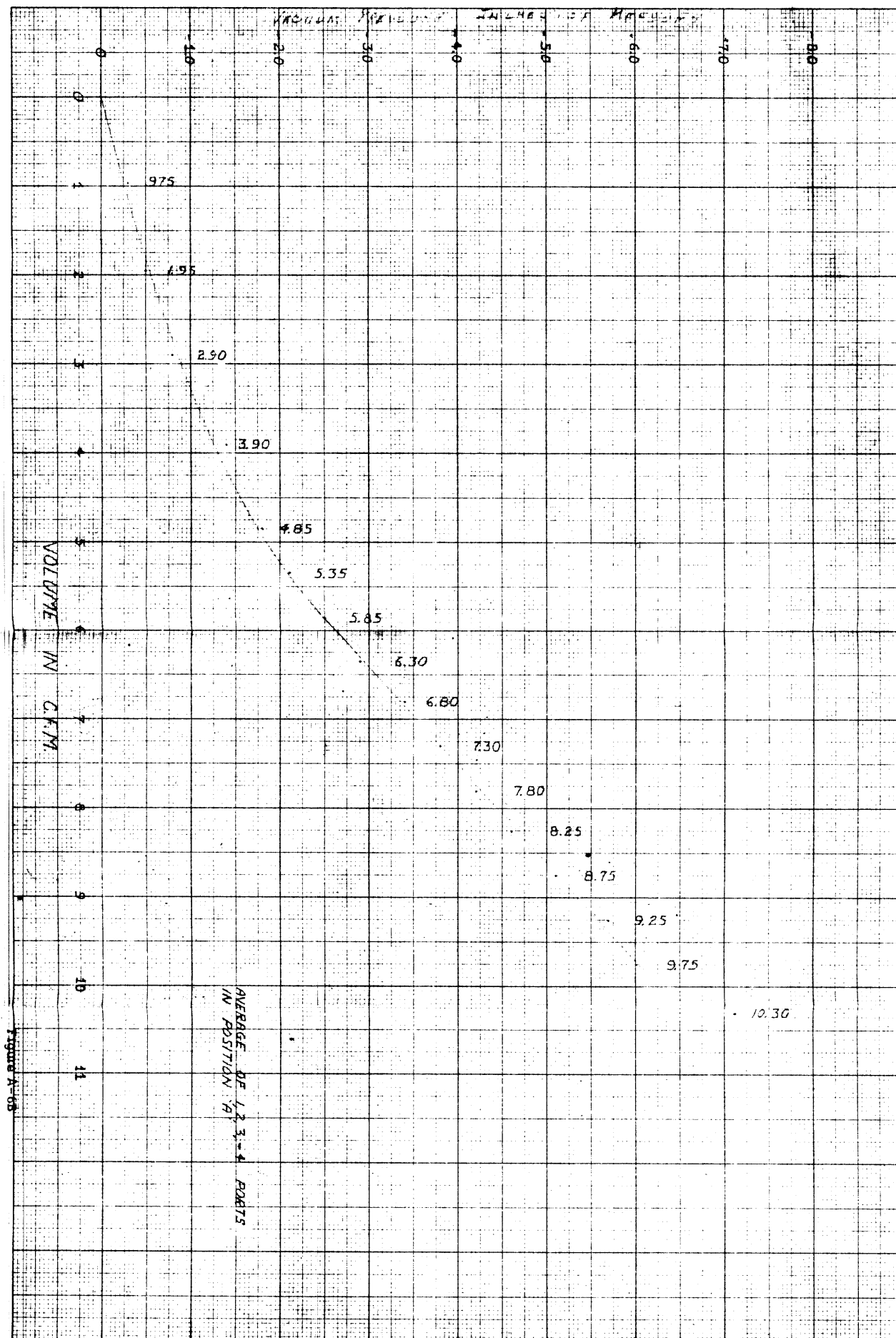
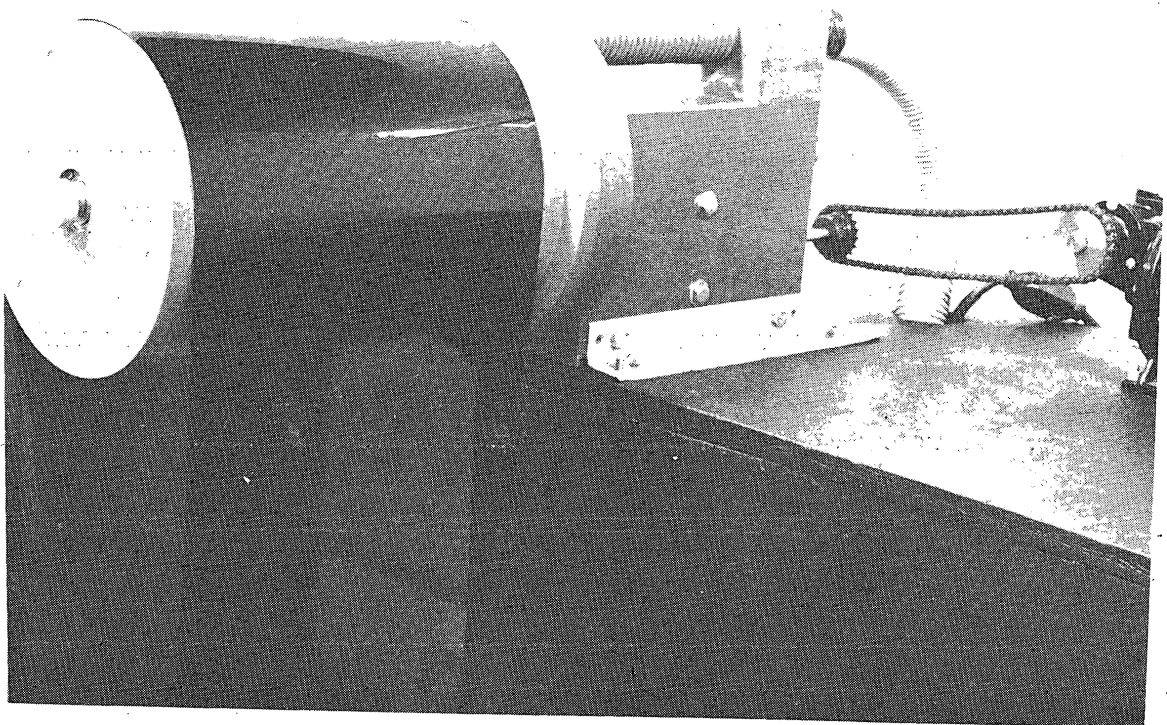
K-E 20 X 20 TO THE INCH 359-104LG
KLUFFEL & ESSER CO.

Figure A-65

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Figure A-7. Vacuum Capstan Test Model

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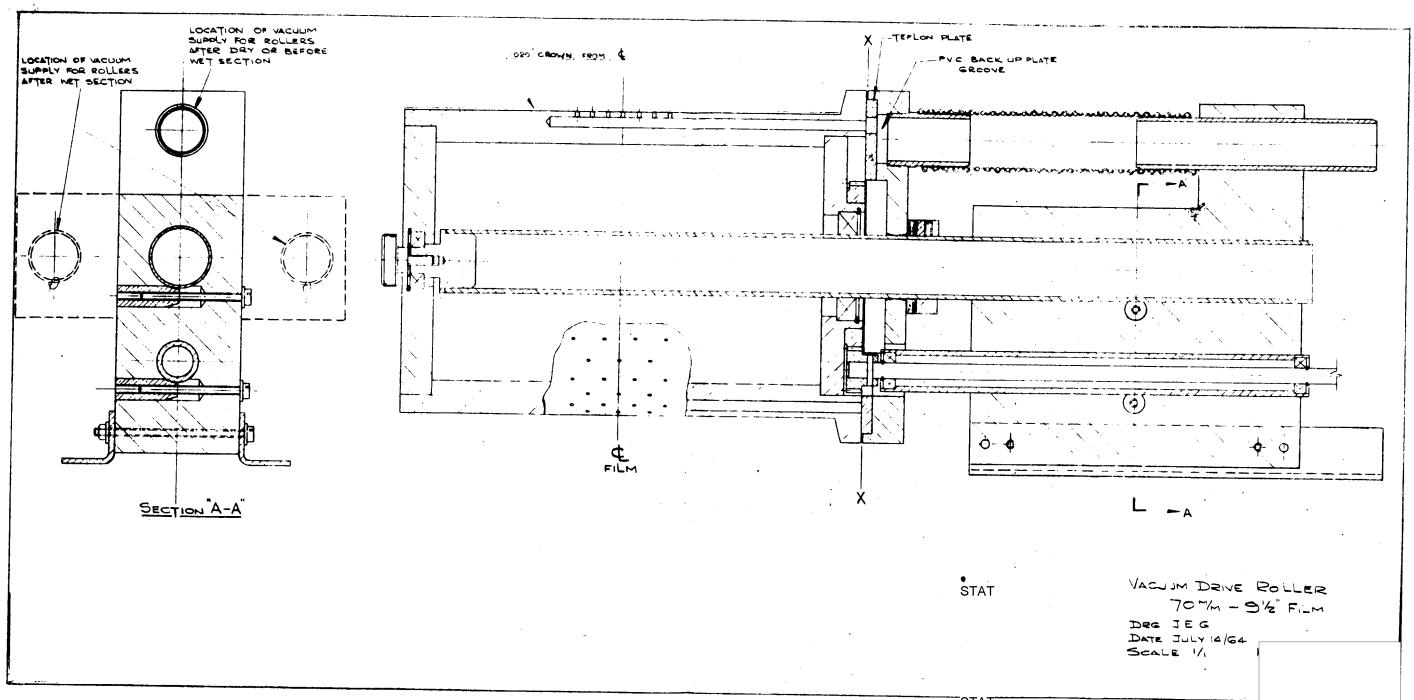


Figure A-8. Vacuum Capstan Schematic Diagram

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MAGNETIC CARD CONTROLLED
SECURITY ENTRANCE

[illegible]

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- VALVE COVERHOSE SPECIFICATIONS
- DIMENSIONS ARE IN INCHES.
BREAK ALL SHARP EDGES.
FRAC TION S 1/8
DECIMALS X = 0.00 XX = 0.01 XXX = 0.00
ANGLES S 1/8"
- HEAT TREAT
- PARTS

REQD	ITEM	PART NUMBER	DESCRIPTION	MATERIAL	QTY. REQD
LIST OF MATERIAL					
			TITLE		
			FLOOR PLAN		
			CLEAN ROOM		
			R&D FACILITY		
			PRELIMINARY ONLY		
			SCALE 1/4" = 1'-0"		

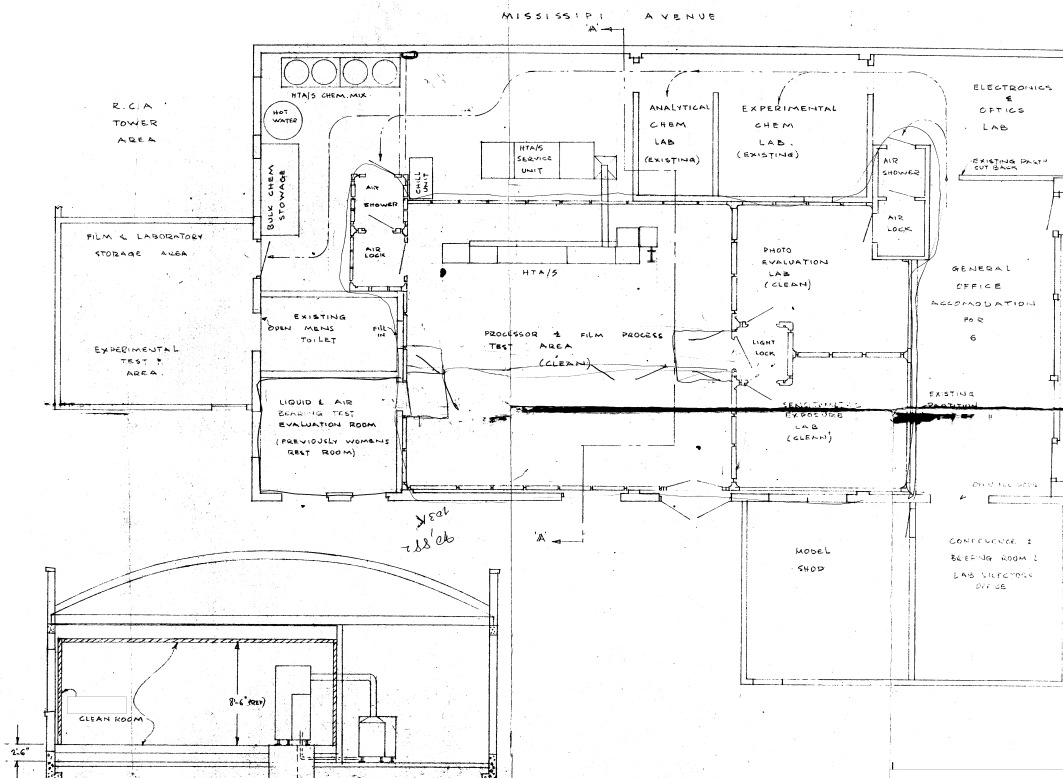
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REVISIONS			
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SECTION AT 'A-A'

STANDARD CONSTRUCTION SPECIFICATIONS			
FOUNDATION	CONCRETE	FOUNDATION	CONCRETE
WALLS	CONCRETE	WALLS	CONCRETE
FLOOR	CONCRETE	FLOOR	CONCRETE
CEILING	CONCRETE	CEILING	CONCRETE